1. A method of fabricating a gallium nitride-based semiconductor structure on a substrate, the method comprising:

forming a mask having an opening on said substrate;

growing an epitaxial layer selected from the group consisting of gallium nitride and Group III nitride alloys of gallium nitride vertically from the opening and laterally across the mask; and

maintaining the lateral growth rate of said epitaxial layer at a rate sufficient to prevent polycrystalline nitride material nucleating on the mask from interrupting the lateral growth of said epitaxial layer.

2. A fabrication method according to Claim 1 comprising maintaining the lateral growth rate greater than the vertical growth rate.

3. A fabrication method according to Claim 1 comprising maintaining the ratio of the lateral growth rate to the vertical growth rate greater than about 1:1.

4. A fabrication method according to Claim 1 comprising maintaining the ratio of the lateral growth rate to the vertical growth rate at between about 1:1 and 4.2:1.

5. A fabrication method according to Claim 1 comprising maintaining the ratio of the lateral growth rate to the vertical growth rate greater than about 4.2:1.

6. A fabrication method according to Claim 3 comprising maintaining the lateral growth rate at between about 2 and 8 microns per hour.

7. A fabrication method according to Claim 1 wherein the substrate comprises silicon carbide.

8. A fabrication method according to claim 1, further comprising:

growing a buffer layer through the opening in the mask, wherein said buffer layer will support the epitaxial growth of Group III nitrides thereon.

9. A fabrication method according to Claim 8 wherein the step of growing the buffer layer comprises growing a layer of $Al_xGa_{1-x}N$ where $0 \leq x \leq 1$.

10. A fabrication method according to Claim 9 wherein the buffer layer forms a conductive interface to the substrate.

11. A method of fabricating a gallium nitride-based semiconductor structure on a substrate, the method comprising:

forming a mask having an opening therein on a substrate;

growing an epitaxial layer selected from the group consisting of gallium nitride and Group III nitride alloys of gallium nitride vertically from the opening and laterally across the mask under conditions such that polycrystalline nitride material is not inhibited from nucleating on the mask;

wherein the laterally growing epitaxial layer overgrows the polycrystalline nitride material.

12. A fabrication method according to Claim 11 comprising maintaining the lateral growth rate greater than the vertical growth rate.

13. A fabrication method according to Claim 11 comprising maintaining the ratio of the lateral growth rate to the vertical growth rate greater than about 1:1.

14. A fabrication method according to Claim 11 comprising maintaining the ratio of the lateral growth rate to the vertical growth rate at between about 1:1 and 4.2:1.

15. A fabrication method according to Claim 11 comprising maintaining the ratio of the lateral growth rate to the vertical growth rate greater than about 4.2:1.

16. A fabrication method according to Claim 13 comprising maintaining the lateral growth rate at between about 2 and 8 microns per hour.

17. A fabrication method according to Claim 11 wherein growth of the epitaxial layer is performed at about 1060 to 1120 °C.

18. A fabrication method according to Claim 11 comprising forming the mask on a silicon carbide substrate.

19. A fabrication method according to Claim 18 comprising forming a striped mask oriented along the $\langle 1\bar{1}00 \rangle$ direction on the (0001) surface of the SiC substrate.

20. A fabrication method according to claim 11, further comprising:

growing a buffer layer through the opening in the mask, wherein said buffer layer will support the epitaxial growth of Group III nitrides thereon.

21. A fabrication method according to Claim 20 wherein the step of growing the buffer layer comprises growing a layer of $Al_xGa_{1-x}N$ where $0 \leq x \leq 1$.

22. A fabrication method according to Claim 21 wherein the buffer layer forms a conductive interface to the substrate.

23. A fabrication method according to Claim 20 comprising growing the buffer layer to a thickness greater than the thickness of the mask.

24. A fabrication method according to Claim 11 comprising growing the epitaxial layer by vapor phase epitaxy using one or more source gases selected from the group consisting of trimethyl gallium, trimethyl aluminum, and ammonia.

25. A fabrication method according to Claim 11 comprising forming a mask that includes a plurality of openings and growing the buffer and epitaxial layers from a plurality of the openings.

26. A fabrication method according to Claim 25 comprising growing the epitaxial layer until laterally growing portions coalesce.

27. A method of fabricating a gallium nitride-based semiconductor structure on a substrate, the method comprising:

forming a mask having at least two openings therein on a substrate;

growing a buffer layer on the substrate within the openings in the mask; and

growing an epitaxial layer selected from the group consisting of gallium nitride and Group III nitride alloys of gallium nitride upwardly from the buffer layer and laterally across the mask;

while maintaining the horizontal growth rate of the gallium nitride layer at a rate sufficient to prevent polycrystalline material nucleating on the mask from interrupting the lateral growth of the gallium nitride layer until the lateral growth from the openings coalesces; and

thereafter continuing to grow the epitaxial layer vertically.

28. A fabrication method according to claim 27, further comprising:

after the lateral growth from the openings coalesces, increasing the rate of vertical growth of the coalesced epitaxial layer.

29. A fabrication method according to Claim 27 comprising maintaining the lateral growth rate greater than the vertical growth rate.

30. A fabrication method according to Claim 29 comprising maintaining the ratio of the lateral growth rate to the vertical growth rate greater than about 1:1.

31. A fabrication method according to Claim 29 comprising maintaining the ratio of the lateral growth rate to the vertical growth rate at between about 1:1 and 4.2:1.

32. A fabrication method according to Claim 29 comprising maintaining the ratio of the lateral growth rate to the vertical growth rate greater than about 4.2:1.

33. A fabrication method according to Claim 30 comprising maintaining the lateral growth rate at between about 2 and 8 microns per hour.

34. A fabrication method according to Claim 27 comprising masking the substrate using a technique selected from the group consisting of plasma-enhanced chemical vapor deposition, sputtering, reactive sputtering, electron-beam deposition and thermal oxidation.

35. A fabrication method according to Claim 27 comprising masking a SiC substrate.

36. A fabrication method according to Claim 27 wherein the step of growing the buffer layer comprises growing a layer of $Al_xGa_{1-x}N$ where $0 \leq x \leq 1$.

37. A fabrication method according to Claim 36 wherein the buffer layer forms a conductive interface to the substrate.

38. A fabrication method according to Claim 36 comprising growing the buffer layer by vapor phase epitaxy using trimethyl gallium, trimethyl aluminum, and ammonia as the source gases.

39. A fabrication method according to Claim 27 comprising growing the buffer layer to a thickness greater than the thickness of the mask.

40. A fabrication method according to Claim 27 comprising growing the epitaxial layer by vapor phase epitaxy using one or more source gases selected from the group consisting of trimethyl gallium, trimethyl aluminum, and ammonia.

41. A method of fabricating a gallium nitride-based semiconductor structure on a substrate, the method comprising:

forming a mask on a substrate that includes both at least one trench and at least one raised portion adjacent the trench, and with the mask having at least one opening therein on the raised portion of the substrate;

growing a buffer layer on the raised portion of the substrate within the opening in the mask; and

growing an epitaxial layer selected from the group consisting of gallium nitride and Group III nitride alloys of gallium nitride upwardly from the buffer layer and laterally across the trench.

42. A fabrication method according to Claim 41 comprising growing the buffer layer to a thickness greater than the thickness of the mask.

43. A fabrication method according to Claim 41 comprising forming at least two raised portions adjacent to the trench and growing the epitaxial layer until it coalesces over the trench.

44. A fabrication method according to Claim 41 wherein the step of forming the mask comprises forming the mask and then forming the opening therein.

45. A fabrication method according to Claim 41 comprising forming the mask on a silicon carbide substrate.

46. A method of fabricating a gallium nitride-based semiconductor structure on a substrate, the method comprising:

forming at least one trench in a substrate to thereby define both the trench and a raised portion immediately adjacent the trench;

forming a mask on the trenched substrate with the mask having at least one opening therein on the raised portion of the substrate;

growing a buffer layer on the raised portion of the substrate through the opening in the mask; and

growing an epitaxial layer selected from the group consisting of gallium nitride and Group III nitride alloys of gallium nitride upwardly from the buffer layer and laterally across the trench

47. A fabrication method according to Claim 46 wherein the step of forming the trench comprising etching the trench in the substrate.

48. A fabrication method according to Claim 47 wherein the etching step comprises a reactive ion etch.

49. A fabrication method according to Claim 46 wherein the step of forming the buffer comprises forming the buffer using vapor phase epitaxy.

50. A fabrication method according to Claim 46 comprising growing the buffer layer to a thickness greater than the thickness of the mask.

51. A fabrication method according to Claim 46 comprising forming at least two raised portions adjacent to the trench and growing the epitaxial layer until it coalesces over the trench portion.

52. A fabrication method according to Claim 46 wherein the step of forming the mask comprises forming the mask and then forming the opening therein.

53. A fabrication method according to Claim 46 comprising forming the mask using a technique selected from the group consisting of plasma-enhanced chemical vapor

deposition, sputtering, reactive sputtering, electron-beam deposition and thermal oxidation.

54. A method of fabricating a gallium nitride-based semiconductor device on a silicon carbide substrate, the method comprising:

etching a plurality of substantially parallel trenches in a silicon carbide substrate that define respective raised portions of the substrate therebetween;

masking the trenched substrate;

opening a plurality of windows in the mask on the raised portions of the substrate;

growing a buffer layer vertically in the windows on the raised portions; and

growing an epitaxial layer selected from the group consisting of gallium nitride and Group III nitride alloys of gallium nitride vertically and laterally from the buffer layer and extending across a plurality of the trenches.

55. A fabrication method according to Claim 54 comprising maintaining the vertical and horizontal growth rates of the gallium nitride layer at rates sufficient to prevent polycrystalline material that may nucleate on the mask from interrupting the lateral growth of the gallium nitride layer.

56. A fabrication method according to Claim 55 comprising maintaining the lateral growth rate equal to or greater than the vertical growth rate.

57. A fabrication method according to Claim 55 comprising maintaining the ratio of the lateral growth rate to the vertical growth rate greater than about 1:1.

58. A fabrication method according to Claim 55 comprising maintaining the ratio of the lateral growth rate to the vertical growth rate at between about 1:1 and 4.2:1.

59. A fabrication method according to Claim 55 comprising maintaining the ratio of the lateral growth rate to the vertical growth rate greater than about 4.2:1.

60. A fabrication method according to Claim 57 comprising maintaining the lateral growth rate at between about 2 and 8 microns per hour.

61. A fabrication method according to Claim 54 comprising masking the substrate using a technique selected from the group consisting of plasma-enhanced chemical vapor deposition, sputtering, reactive sputtering, electron-beam deposition and thermal oxidation.

62. A fabrication method according to Claim 54 comprising masking the (0001) surface of the SiC substrate along the $<1\bar{1}00>$ direction.

63. A fabrication method according to Claim 54 wherein the step of growing the buffer layer comprises growing a layer of $Al_xGa_{1-x}N$ where $0 \leq x \leq 1$.

64. A fabrication method according to Claim 63 wherein the buffer layer forms a conductive interface to the substrate.

65. A fabrication method according to Claim 63 comprising growing the buffer layer by vapor phase epitaxy using trimethyl gallium, trimethyl aluminum, and ammonia as the source gases.

66. A fabrication method according to Claim 54 comprising growing the buffer layer to a thickness greater than the thickness of the mask.

67. A fabrication method according to Claim 54 comprising growing the epitaxial layer by vapor phase epitaxy using one or more source gases selected from the group consisting of trimethyl gallium, trimethyl aluminum, and ammonia.

68. A method according to Claim 54 comprising opening the windows following the step of forming the mask.

69. A method according to Claim 54 comprising forming the windows while masking the trenched substrate.

70. A semiconductor structure comprising:

a substrate having an upper surface;

a mask directly on said upper surface of said substrate, and having at least one window therein; and

an overgrown epitaxial layer selected from the group consisting of gallium nitride and Group III nitride alloys of gallium nitride and extending upwardly from said mask window and laterally across said mask;

wherein polycrystalline material has nucleated on said mask.

71. A semiconductor structure according to Claim 70 wherein said mask comprises a refractory metal.

72. A semiconductor structure according to Claim 70 wherein said mask is reflective.

73. A semiconductor structure according to Claim 70 wherein said mask is a Bragg reflector.

74. A semiconductor structure according to Claim 70 wherein said mask is selected from the group consisting of Si_xN_y, SiO2, platinum and tungsten.

75. A semiconductor structure according to Claim 70 wherein said substrate is selected from the group consisting of silicon carbide, sapphire, silicon, gallium arsenide and zinc oxide.

76. A semiconductor structure according to Claim 70 wherein said substrate is silicon carbide and has a polytype selected from the group consisting of the 4H, 6H, 3C and 15R polytypes.

77. A semiconductor structure according to Claim 70 and further comprising a buffer layer between said substrate and said epitaxial layer.

78. A fabrication method according to Claim 77 wherein the buffer layer forms a conductive interface to the substrate.

79. A semiconductor structure according to Claim 77 wherein said substrate comprises sapphire and said buffer layer is formed of $Al_xGa_{1-x}N$ where $0 \leq x \leq 1$.

80. A semiconductor structure according to Claim 70 comprising a plurality of windows in said mask.

81. A semiconductor structure according to Claim 80 wherein said epitaxial layer is coalesced between said windows.

82. A gallium-nitride based semiconductor structure comprising:

a substrate having an upper surface and at least two raised portions of said upper surface that define at least one trench therebetween;

a mask structure that overlays said substrate, said mask structure having a window that exposes at least a portion of said upper surface of said raised portion of said substrate; and

an overgrown epitaxial layer selected from the group consisting of gallium nitride and Group III nitride alloys of gallium nitride extending upwardly from said mask windows and laterally over said trench and across said mask .

83. A semiconductor structure according to Claim 82 comprising nucleated polycrystalline material on said mask.

84. A semiconductor structure according to Claim 82 wherein said nucleated polycrystalline material is in said trench.

85. A semiconductor structure according to Claim 82 wherein said substrate is selected from the group consisting of silicon carbide, sapphire, silicon, gallium arsenide and zinc oxide.

86. A semiconductor structure according to Claim 85 wherein said substrate is selected from the group consisting of silicon carbide and sapphire and wherein said structure further comprises a buffer between said substrate and said epitaxial layer.

87. A semiconductor substrate according to Claim 82 wherein said mask comprises Si_xN_y.

88. A semiconductor structure according to Claim 82 wherein portions of said epitaxial layer portions are coalesced over said at least one trench.

89. A semiconductor structure according to Claim 82 comprising a buffer layer on said substrate in said window in said mask.

90. A semiconductor structure according to Claim 82 comprising a plurality of trenches, a plurality of raised portions with at least two of said raised portions having said windows therein.

91. A semiconductor structure comprising:

a silicon carbide substrate having an upper surface;

a Si_xN_y mask directly on said upper surface of said substrate, and having at least one window therein;

a buffer layer of $Al_xGa_{1-x}N$ where $0 \leq x \leq 1$within said mask window; and

an overgrown epitaxial layer selected from the group consisting of gallium nitride and Group III nitride alloys of gallium nitride and extending upwardly from said mask window and laterally across said mask;

wherein polycrystalline material has nucleated on said mask.

92. A gallium-nitride based semiconductor structure comprising:

a silicon carbide substrate having an upper surface and at least two raised portions of said upper surface that define at least one trench therebetween;

a Si_xN_y mask structure that overlays said substrate, said mask structure having a window that exposes at least a portion of said upper surface of said raised portion of said substrate; and

a buffer layer of $Al_xGa_{1-x}N$ where $0 \leq x \leq 1$within said mask window; and

an overgrown epitaxial layer selected from the group consisting of gallium nitride and Group III nitride alloys of gallium nitride extending upwardly from said mask windows and laterally over said trench and across said mask .